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ANDERSEN AFB
GUAM

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 661

THE UNITED STATES AIR FORCE
INSTALLATION RESTORATION PROGRAM

ENGINEERING EVALUATION/COST ANALYSIS
FOR
SITE 2/LANDFILL 2
INSTALLATION RESTORATION PROGRAM
WASTE CONSOLIDATION UNIT

ANDERSEN AIR FORCE BASE, GUAM

December 2004

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ABBREVIATIONS, ACRONYMS, AND TERMS

AFB	Air Force Base
AMSL	Above Mean Sea Level
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
BTV	Background Threshold Level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminants of Concern
COPC	Constituents of Potential Concern
CWA	Clean Water Act
DD	Decision Document
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right To Know Act
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HSP	Health and Safety Plan
IRP	Installation Restoration Program
lcy	Loose cubic yards
LTM	Long-term Monitoring
MCL	Maximum Contaminant Level
MLLW	Mean lower low water
MSWL	Municipal Solid Waste Landfill
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	Operations and Maintenance
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RGO	Remedial Goal Objectives
TCE	Trichloroethylene
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This document serves as an Engineering Evaluation/Cost Analysis (EE/CA) for the Installation Restoration Program (IRP) Site 2/Landfill 2 located at Andersen Air Force Base, Guam. This EE/CA has been prepared as part of a non-time-critical removal action that uses the United States Environmental Protection Agency (USEPA) presumptive remedy approach to select a containment system for the landfill. This EE/CA provides a comparative analysis of different containment system alternatives; an alternative is selected based on the results of the comparative analysis.

As part of the remedial action at Site 2/Landfill 2, non-hazardous remedial wastes from Site 24/Landfill 29 and Site 35/Waste Pile 1 were consolidated with Site 2/Landfill 2 non-hazardous wastes. Andersen Air Force Base will continue to utilize this site to consolidate non-hazardous remedial wastes from additional sites that have gone through the CERCLA evaluation process and that generate remedial wastes.

Under the No Action Alternative non-hazardous remedial wastes from multiple Andersen sites will be disposed of in the Andersen Landfill. This remedial waste will reduce the life expectancy of the Andersen Landfill by 6 years from 9 years to 3 years.

The Andersen IRP has disposed of approximately 35,000 cubic yards of non-hazardous remedial waste in the active Andersen Municipal Solid Waste Landfill (MSWL). This material disposal process has negatively impacted the life of the landfill. An examination of CERCLA disposal options concluded that development of a waste consolidation unit is in the best interest of the Air Force. Remedial wastes will be consolidated in Site 2/Landfill 2. Wastes will be buried in an existing open mining pit or in newly excavated trenches and covered with an asphalt mix and coral. Following the addition of impacted soils, and non-hazardous asphalt debris, the mine pit will be filled to a depth of one foot below original ground surface. A minimum of one foot of clean coral material would then be applied to cover impacted areas to original ground surface contour. Similarly, remedial wastes placed into trenches would be covered in a like fashion to facilitate drainage, limit infiltration, and minimize erosion.

The Air Force has selected the Consolidation Unit Alternative at Site 2/Landfill 2 to extend the life expectancy of the Andersen Landfill and provide an alternate site for disposal of non-hazardous remedial waste. The operating cost for the Consolidation Unit Alternative through FY2006 is approximately $612,000. The construction cost for the Andersen Landfill was approximately $5,000,000. This number divided by the permitted capacity of the landfill equates to a $28 per cubic yard cost for the material being delivered to the landfill. The diversion of remedial wastes from the landfill will save landfill space valued at approximately $1,100,000.

The schedule for the EE/CA report and removal action is provided below:

i.	Air Force Draft EE/CA for internal review	July 2004
ii.	Agency Draft EE/CA for regulatory review	December 2004

iii	Decision Memorandum	January 2005
iv.	Funding and Award of Removal Actions	December 2004
		March 2006
		March 2007
v.	Submission of Multiple Removal Verification Reports	
		December 2005
		December 2006
		December 2008

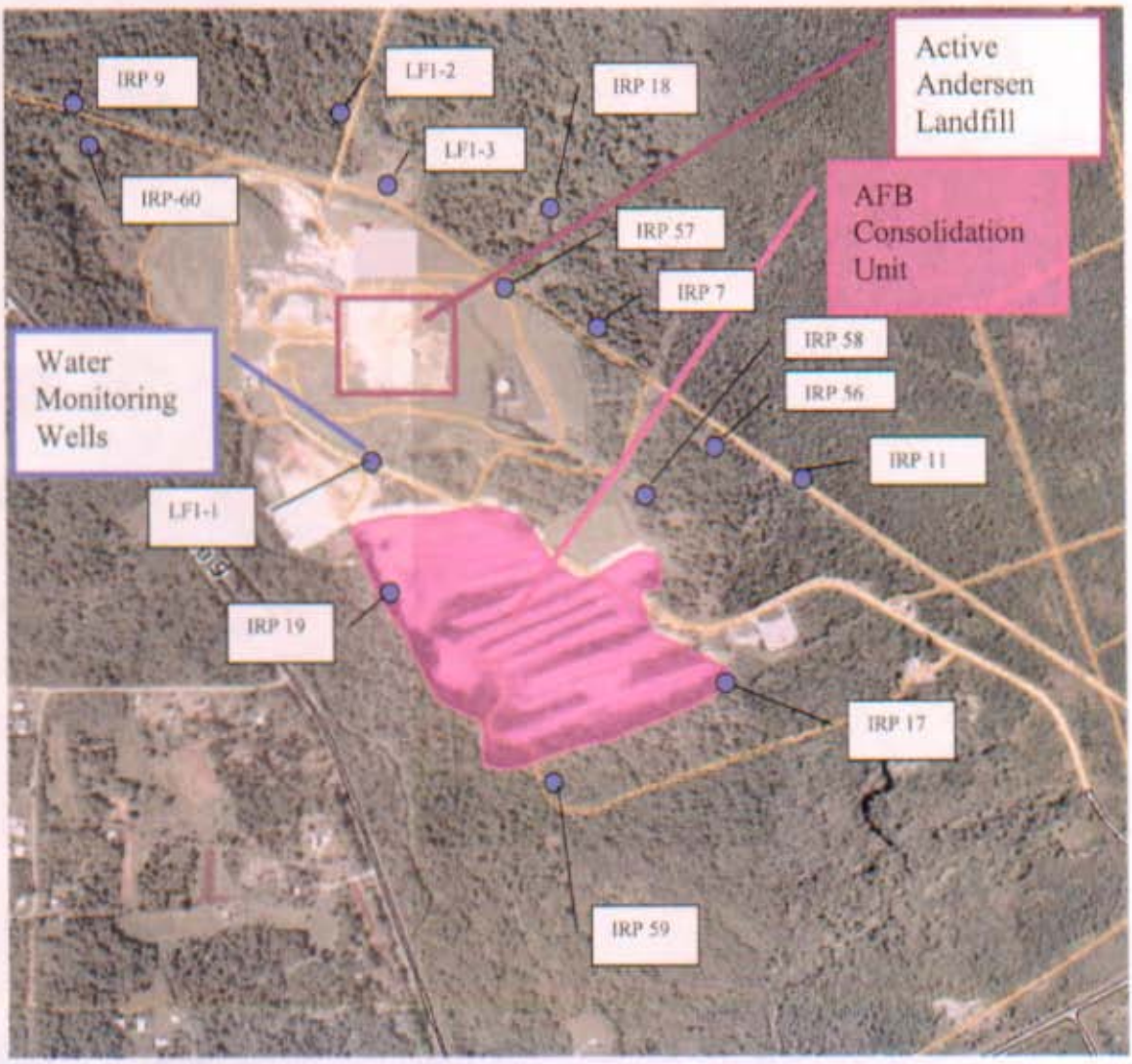
Engineering Evaluation/Cost Analysis
Site 2/Landfill 2 Consolidation Unit

1. INTRODUCTION

This document serves as an Engineering Evaluation/Cost Analysis (EE/CA) for the Andersen Air Force Base (AFB) Installation Restoration Program (IRP) Site Consolidation Unit on Guam. IRP restoration work conducted in 2000 and 2001 consolidated remedial wastes from Site 24/Landfill 29, Site 35/Waste Pile 1, and Site 2/Landfill 2 into Site 2/Landfill 2. This EE/CA will examine the efficacy of continued use of the same site for consolidation of remedial wastes from additional sites on and adjacent to Andersen AFB.

Site 2/Landfill 2 is located on the main base portion of AFB (Figure 1).

Figure 1. AFB CONSOLIDATION UNIT



Landfill 2 is a 69-acre partially vegetated parcel of land gently sloping to the northeast. The surface is a mosaic of covered waste disposal trenches interspersed with strips of grass, trees, and shrubs. No evidence of surface water is present since most of rainfall runs off of the area or percolates into the vegetated areas. Land use near the site consists of open space dominated by the active Andersen MSWL, Landfill 5, a RCRA capped hazardous waste disposal area; World War II asphalt storage and housing facilities areas; and jungle. The nearest population consists of Andersen personnel housing, approximately one mile to the southeast, and off-base civilian housing, approximately one half mile to the west. Future development plans for this area currently envision continued landfill activity. Institutional controls restrict future land use by ensuring that covers/caps are maintained and that no invasive development will occur.

Site 2/Landfill 2 was reportedly used from the mid-1940s to mid-1970s for disposal activities involving the dumping and burning of wastes generated by maintenance and household activities on Andersen Air Force base. Trenches were excavated and filled with wastes. No records of disposal practices or waste quantities are available for any of the periods of waste disposal activity.

2. SITE SUMMARY

Guam lies 13° 27' (about 900 miles) north of the equator, creating a year round warm climate. The mean annual temperature is 81 degrees Fahrenheit (°F). Daily temperatures typically range from the low 70's (°F) to the high 80's (°F). Humidity ranges from between 65 to 80 percent in the late afternoon and 85 to 100 percent at night. The annual rainfall for the area is 90.8 inches per year. Large rain events associated with typhoons are not uncommon with as much as 24.9 inches of precipitation for a 24-hour period (Ward et al., 1965). There are only two seasons on the island, a wet and dry season. The wet season extends from July to November and the dry season extends from December to June. Easterly trade winds are common throughout the year, and are prevalent from January to May.

The island of Guam has two distinct physiographic provinces, the Northern Limestone Plateau and the Southern Volcanics. The Adelup Fault separates these two provinces. South of the fault, the island is composed almost entirely of volcanic rocks and north of the fault the island is composed almost entirely of limestone (excluding portions of Mt. Santa Rosa and Mataguac Hill) with karst topography (Mariana or Barrigada Limestone). Andersen AFB is situated on an undulating limestone plateau with surficial karst features. The geology of the Main Base consists of reef limestone deposits, the Mariana and Barrigada Limestones, which are underlain by the volcanic rocks of the Alutom Formation (Tracey et al., 1964).

In September 1991, a geologic and hydrogeologic investigation was performed for the Active Landfill Complex under the Modified Closure Plan for the Landfill Area (ICF, 1994b). Eleven boreholes were completed in the Landfill Complex during 1991 and 1992 to obtain data for the establishment of a credible long-term groundwater monitoring network. All of the boreholes were completed to the Alutom Formation.

The geology underlying the site consists of limestone deposits, which are underlain by volcanics. The Barrigada Limestone is a massive, well lithified to friable; medium to coarse grain, foraminiferal limestone characterized by the foraminifera Operculina, Gypsina, and Cycloclypeus (Tracey et al., 1964). The Barrigada Limestone is estimated to be 540 feet thick and is Miocene aged (5 to 24 million years old). The Barrigada Limestone, which is the principal water bearing unit underlying northern Guam is highly permeable and porous with numerous voids, fissures, fractures, and solution openings. The Mariana limestone lies unconformably above the Barrigada Limestone. The Mariana Limestone is characterized by molluscan facies, fine-grained white to tan detrital limestone of lagoonal origin containing abundant casts and molds of mollusks, predominately pelecypods.

Limestone thickness varies from approximately 390 feet to 830 feet. During the 1991 through 1992 geologic investigation, it was observed that the coralline limestone below 300 feet bgs was typically white to tan in color with some replacement of the coralline limestone with recrystallized calcite and calcite cement. The change in composition could be indicative of the contact between the Mariana and Barrigada Limestones (ICF, 1994b).

The Eocene/Oligocene-aged Alutom Formation unconformably underlies the Barrigada Limestone and consists of well-bedded, fine to coarse grain volcanic and volcanolastic rocks. The general slope of the Alutom Formation at the site is steep and to the north.

The local topography in the vicinity of the site is that of an undulating limestone plateau with sinkholes and other karstic features. The surface elevation at the site ranges from 500 to 540 feet above mean sea level (amsl) with a downward slope to the north-northwest.

Because the surface soil and limestone bedrock is very porous and permeable, all precipitation, except that portion lost to evapotranspiration, contributes to the groundwater. Storm water runoff readily infiltrates into the vadose zone preventing the formation of surface streams, rivers, and lakes. The nearest surface water body is the Pacific Ocean located approximately 2 miles northeast of the site.

The soil present at the site consists of the Guam Cobbly Clay Loam with 3 to 7 percent slopes. The soil is very shallow, well drained, and overlies porous coralline limestone. Typically, 5 to 10 percent of the surface is covered by gravel and cobbles (Young, 1988). A dusky red, gravelly clay loam typically characterizes the surface soil, approximately 6 inches thick. Limestone bedrock is generally found 6 to 16 inches bgs. The soil is neutral to mildly alkaline, and permeability is moderately rapid.

Descriptions of soil samples collected at the site identified several types of soil including sands and gravel, silty sand, silty clay, gravelly silts and sand, clayey silts, silty loam, and sandy loam. Soil color ranged from dusky red to dark brown.

The recharge to the aquifer by precipitation is estimated to average 0.77 million-gallons/day/square kilometer (Mink, 1976). Due to lithologic variations in the limestone rocks, the hydraulic conductivity is estimated to vary by four orders of magnitude, from 2

feet/day to 20,000 feet/day. Porosity of the limestone ranges from 15 to 25 percent (Mink, 1976).

Thirteen IRP groundwater monitoring wells (IRP-7, IRP-11, IRP-17, IRP-18, IRP-19, IRP-9, IRP-56, IRP-57, IRP-58, IRP-59, LF1-1, LF1-2 and LF1-3) are located within 1/2 mile of the site (Figure 1). The wells were installed during various stages of the IRP program and during assessment of the Landfill Complex. The IRP groundwater investigation at the Landfill Complex commenced in 1989 with the Phase II, Confirmation/Quantification, Stage 1 investigation (Battelle, 1989). Trichloroethene (TCE) was detected in groundwater samples collected from several wells near Landfill 2.

Results of more recent biannual groundwater sampling from fall 1995 to Fall 2003 indicates that few analytes exceed the MCL. Six monitoring wells are located in close proximity to Site 2. Monitoring wells IRP-17, IRP-19, IRP-56, IRP-58, and LF1-1 are located within or down gradient of the site, while monitoring well IRP-59 is located up gradient of Site 2. TCE has been detected in groundwater samples from IRP-17 in every sampling round since 1989 at concentrations below maximum contaminant levels (MCLs). TCE in IRP-17 has ranged from 4 parts per billion (ppb) in 1989 to 0.5 ppb in 2004. Several other VOCs were detected at low or estimated concentrations in groundwater samples collected from other wells, but at concentrations below the respective MCLs. Bis (2-ethylhexyl) phthalate concentrations, in IRP-19 groundwater samples, exceeded the MCL in one sampling round prior to 2000. An audit of laboratory procedures in 2000 corrected an organic extraction procedure and there have been no Bis (2ethylhexyl) phthalate detections since. No metals have been detected at concentrations exceeding the MCLs in the groundwater samples collected from wells surrounding Site 2. A detailed discussion of groundwater results is presented in the Groundwater Summary Report (EA, 1998b) and the Spring 2003 Groundwater Data Monitoring Report (EA, 2003).

Groundwater elevation contour maps, from Spring 2003, indicate that groundwater in the vicinity of Site 2/Landfill 2 is parabasal, has a steep gradient to the north-northeast and discharges into the Pacific Ocean. The parabasal/basal transition zone is north of the Andersen landfill complex. Depth to water at the site ranges from approximately 350 to 500 feet bgs. The groundwater up gradient (south) of Site 2 in IRP-59 is approximately 351 feet bgs (219 feet above mean lower low water (MLLW). IRP-58, located approximately 2,000 feet north of IRP-59, had a water level of approximately 490 feet bgs (19 feet above MLLW). The relatively steep hydraulic gradient is likely caused by the steeply sloping contact of the Alutom Formation underlying the Mariana or Barrigada Limestone in the area.

Groundwater receptors are addressed in the Groundwater Summary Report for Andersen Air Force Base (EA, 1998b) and in the supplemental Groundwater Data Monitoring Report for Spring 2003 (EA, 2003). There are no groundwater production wells in the vicinity of Site 2. The site is within an industrial area of the base and civilians do not generally access the site. A gate to the site is closed from 3:30 p.m. to 7:30 a.m. daily and all day during the weekends and holidays.

Site 2 is a former landfill located on the Main Base of the Andersen AFB. Although there are several threatened and endangered species within the Andersen AFB boundary, none of the critical habitats for these species are within the Site 2 boundary.

The Final Engineering Evaluation/Cost Analysis (EE/CA) Report for IRP Site 2/Landfill 2, Andersen Air Force Base, Guam, February 2000 evaluated the human and environmental risks associated with the consolidation and burial of IRP wastes from Site 24/Landfill 29, Site 2/Landfill 2, and Site 35/Waste Pile 1. During field investigations soil gas samples were analyzed for volatile organic compounds (VOCs). All surface soil samples were analyzed for semi volatile organic compounds, polycyclic aromatic hydrocarbons (PAHs), pesticides and PCBs, and metals and dioxins. Subsurface samples were analyzed for the same parameters as surface soil samples and in addition, the samples were analyzed for VOCs. The analytical results for soil samples were compared to Environmental Protection Agency (EPA) approved Preliminary Remediation Goals (PRGs) and background threshold values (BTVs) as initial screening criteria for determining the Constituents of Potential Concern (COPCs). Furthermore, each COPC was evaluated in a Human Health Risk Assessment and an Ecological Risk Assessment.

Table 1 outlines the known COPCs presently buried in the proposed Consolidation Unit and shows COPCs at other sites scheduled for consolidation. The highlighted cells in Table 1 indicate COPCs that are not currently buried at Site 2/Landfill 2. These new COPCs are in relatively low concentrations, exhibit low solubility in water, and will be buried thereby reducing the potential for leaching to groundwater and or exposure to human and or ecological pathways.

Based on the Human Health Risk Assessment conducted for the Final Engineering Evaluation/Cost Analysis (EE/CA) Report for IRP Site 2/Landfill 2, Andersen Air Force Base, Guam, February 2000, dioxins were identified as COPC in surface soil for the resident adults and children target groups. Eight analytes (chromium, 4,4'DDD, 4,4'DDT, aroclor 1248, aroclor 1254, aroclor 1260, dieldrin and dioxins) were identified as constituents of concern (COCs) in subsurface soil for resident children. Seven analytes (chromium, 4,4'DDD, aroclor 1248, aroclor 1254, aroclor 1260, dieldrin and dioxins) were identified as COCs in subsurface soil for resident adults. Based on the Lead Uptake Model, lead was also considered a COC in subsurface soil for resident children. According to the Ecological Risk Assessment, there is no ecological risk associated with any of the COPCs at Site 2. There were no risks for trespassers/occasional users based on the current site conditions.

During the time periods April 2001-September 2001 and December 2002-April 2003 approximately 17,059 loose cubic yards (lcy) of stabilized lead- and antimony-contaminated soil, 1,877 lcy of solid debris from Site 24/Landfill 29 mixed with approximately 6,561 lcy of asphalt debris from Site 35/Waste Pile 1, and 492 lcy of soil and debris removed from the trenches crossing the landfill road and surface solid waste from the site were consolidated and buried in Site 2/Landfill 2. Approximately 70,848 lcy of clean coral material was placed and compacted over the top of the remedial wastes.

Additionally, 80 lcy of asbestos containing materials from Site 2/Landfill 2 were excavated and buried in the asbestos cell of the active Andersen Landfill.

Table 2 outlines the schedule, projected volumes, and costs for the Consolidation Unit.

TABLE 2. CONSOLIDATION UNIT SCHEDULE

FY Schedule	IRP Site	Remedial Waste Estimated Volume cu-yds	Consolidation Unit Burial/Construction Cost
2004	Ritidian Point	7500	
	Subtotal		$101,630.00
2005	LF20	1000	
	LF13	1000	$100,000.00
	LF14	3500	
	LF19	2600	
	FTA-2	312	
	Subtotal		$100,000.00
2006	Urunao	825	$100,000.00
	LF8	5	$310,000.00
	LF17	14410	
	LF18	8000	
	Subtotal		$410,000.00
	Volume totals	39152	
	Estimated Costs		$ 611,630.00

3. SELECTION CRITERIA

Two remedial action alternatives were evaluated for addressing the proposed action. These remedial action alternatives were the *No Action Alternative* and the *Consolidation Unit Alternative.*

Remedial Action Objectives for this project are based upon specific implemental technologies. Site 2/Landfill2 has been previously utilized as a Consolidation Unit for remedial wastes from several IRP cleanup actions.

Under the No Action Alternative, COC-impacted soil from multiple IRP sites would not be buried in Landfill 2 but would be buried in the active Andersen Landfill or sent to an off-island Treatment, Storage, and Disposal Facility. If the remedial waste volume outlined in Table 2 were to be buried in the landfill the remaining life of the facility would be reduced by 66 percent, from 9 years to 3 years.

Under the Consolidation Unit Alternative, eligible waste from Site 36/Ritidian Point Dump Site, Site 10/Landfill 14, Site 15/Landfill 20, Site 6/Landfill 8, Site 19/ Landfill 18, Site 26/FTA 2, Site 40/Urunao Dumpsites 1 and 2, Site 9/ Landfill 13, Site 12/Landfill 17, Site 14/Landfill 19, and other yet to be determined sites will be placed in either newly excavated trenches or the existing mined out pit and covered with two feet of material. See Figures 2 and 3 for typical cross sections through filled trenches and the mine pit.

Figures 2 and 3 graphically depict the sequencing of material management in the Consolidation Unit. The open pit area will be utilized initially. Non-hazardous remedial wastes will be hauled into the pit with dump trucks. The wastes will be dumped starting at the back of the excavation and working forward. Once a butt-dumped layer is in place it will be leveled with a dozer, compacted, and a second layer of material will be added. This process will continue until all of the contaminated wastes from a particular remedial site are excavated.

Figure 2 illustrates the burial sequence for the mine pit. This location will be completed in phases based upon the amount of waste arriving from programmed sites. As the material is placed in the pit it will be sloped and covered so that infiltration through the buried wastes does not occur. Best Management Practices will be utilized to control infiltration and erosion from the intermediate surfaces.

FIGURE 2. MINE PIT BURIAL SEQUENCE

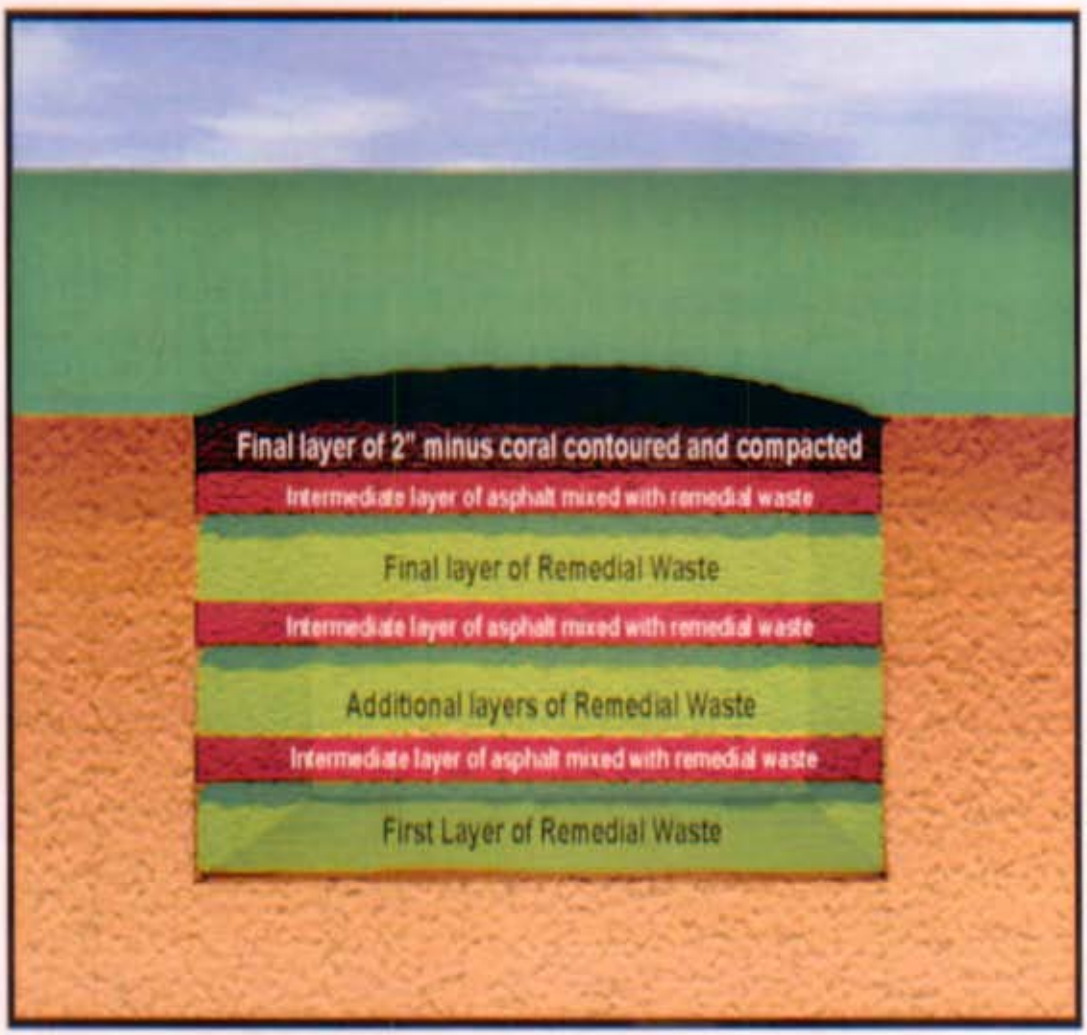


Figure 3 is a typical cross-section through a trench filling operation. The areas between the existing trenches in LF-2 will be excavated to a depth of 10 feet and filled with remedial waste material from IRP sites. The remedial waste material will fill the trench to within a couple feet of the surface so that the asphalt/dirt cover and the final coral cover can be added and compacted. The final contour of the trenches will direct drainage away from the buried material.

FIGURE 3. TRENCH BURIAL SEQUENCE

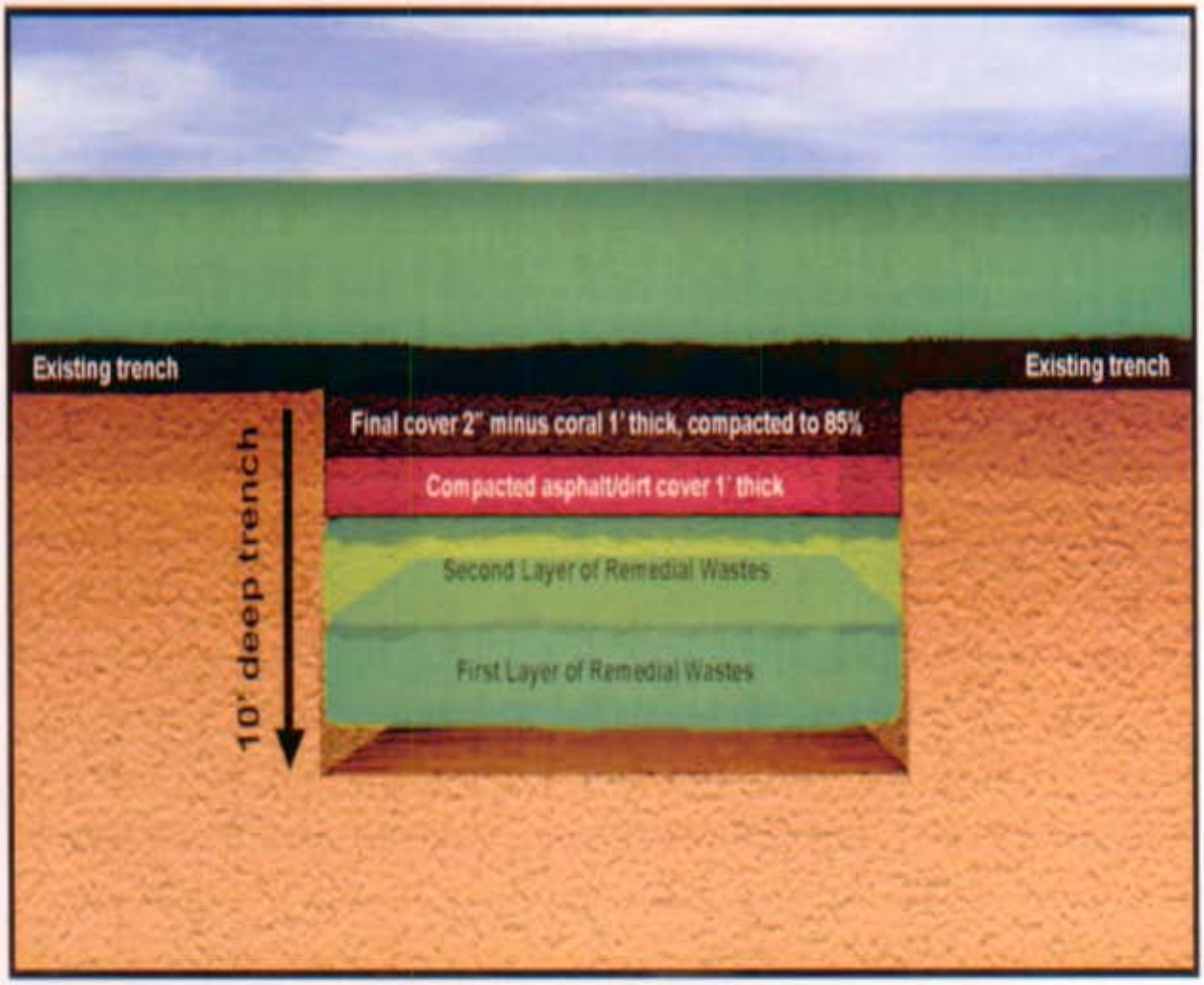
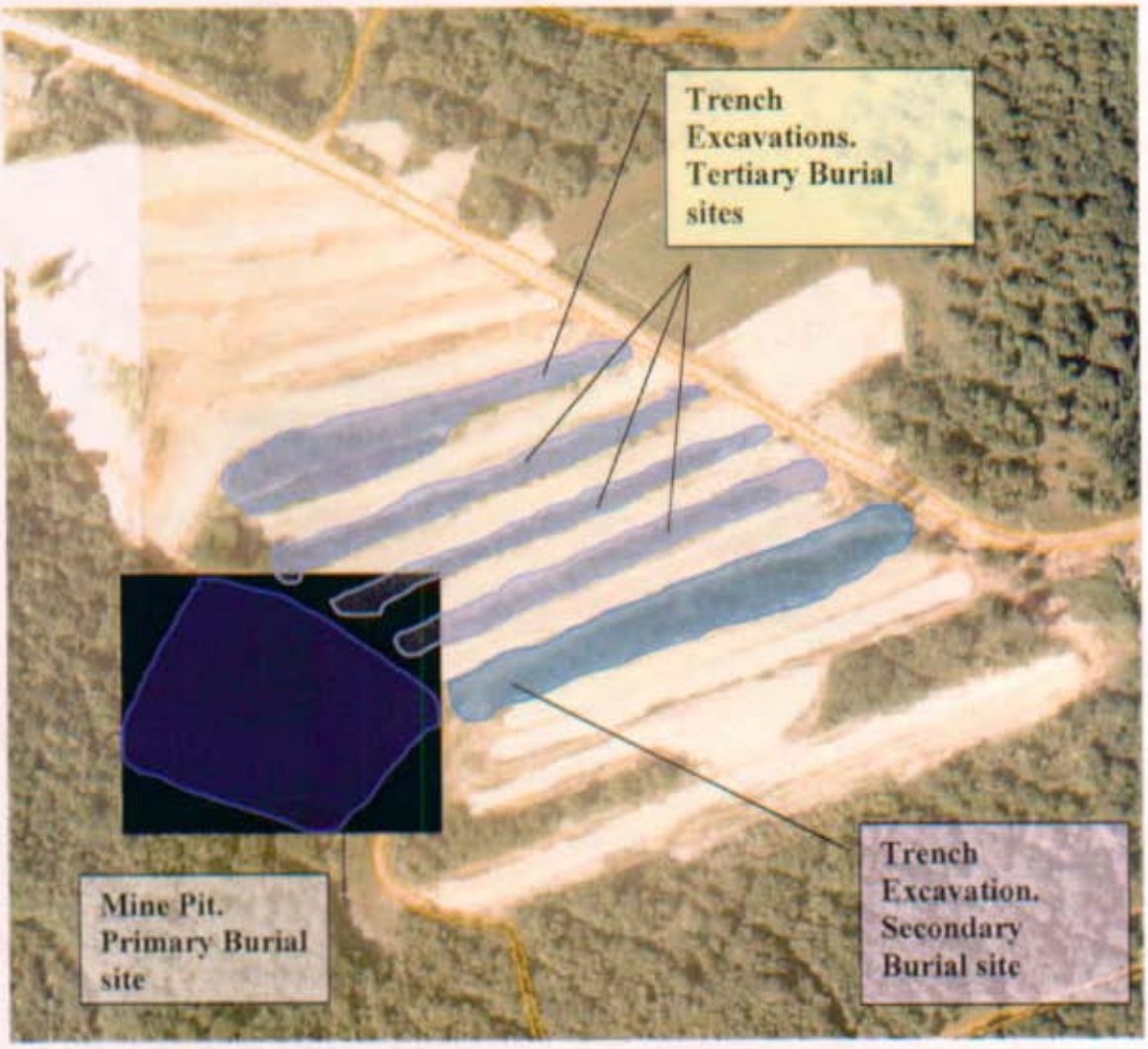


Figure 4 illustrates the planned burial sequence of remedial wastes in the Consolidation Unit. The primary burial site will be the existing mine pit. Once this area is full new trenches will be excavated as required. The first trench to be constructed will be between existing trenches 14 and 15. Subsequent trenches will be excavated to accommodate only the amount of waste to be removed from an IRP site. Trenches will not be left open to act as conduits for groundwater infiltration.

FIGURE 4. CONSOLIDATION UNIT MINE PIT AND TRENCH LOCATIONS



The two containment system alternatives were evaluated according to USEPA guidance in terms of effectiveness, implementability, and cost. Each of the containment alternatives included a landfill cover as well as ground water monitoring and surface water control systems. A leachate collection system was not considered because the compounds in the proposed Consolidation Unit do not readily migrate to groundwater.

4. RECOMMENDATIONS

4.1 LONG-TERM EFFECTIVENESS AND PERMANENCE

The remedial waste material imported to the site will be covered thereby removing the residual risk of exposure to COCs. Migration of contaminants from subsurface to groundwater has been evaluated to ensure that the COCs are not a source of groundwater contamination. No COCs at the site have been detected in groundwater samples at concentrations above the MCLs. In addition, contaminated soil from IRP sites will be stabilized with Triple Super Phosphate (TSP) as needed to reduce the leachability of lead and other metals in the soil. Asphalt residuals and mixtures with eligible wastes are not considered hazardous waste or toxic to human or ecological receptors. As long as the soil cover remains in place there is no risk of exposure to COCs in soil. The Air Force proposes erosion control and institutional control to minimize the disturbance of the soil cover. Institutional control will consist of limiting subsurface excavation at the site. All work conducted at the site will require a work clearance permit which must be approved by the Civil Engineer Squadron. A gradual slope will be applied to the surface cover to control surface water runoff. An Operation and Maintenance Program, already in effect through the Andersen IRP, consists of checking the covers for erosion, correcting any that may occur, and removing any vegetation that may compromise cover integrity. A groundwater-monitoring program will be maintained in conjunction with the active Base Landfill requirements.

4.2 REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT

Approximately 40,000 cubic yards of soil containing COCs from multiple sites will be consolidated and buried in the Consolidation Unit. Treatment with TSP and or asphalt to reduce the leachability of COCs from the soil will be done as required. While this does not reduce the volume of waste material at Site 2, the treatment does reduce the mobility of lead in soil and reduces the amount of soil that would otherwise be transported and disposed off-island as material characterized as hazardous waste. Also, placing these soils in Site 2/Landfill 2 rather than the Base Landfill will minimize the impact to the anticipated lifetime of the Landfill. Approximately 6 years of landfill life will be realized by utilizing the Consolidation Unit to dispose of IRP remedial wastes. Imported eligible wastes will be covered to eliminate the exposure pathways to human and ecological receptors.

4.3 SHORT-TERM EFFECTIVENESS

During the placement process of remedial waste there is a possibility that workers in the area or those workers conducting the action may be exposed to COCs. There are no nearby residents in the vicinity of the site. The closest human receptors, excluding the removal action workers, are workers at the active Base Landfill. In particular, workers utilizing the road (traversing through the site) may be exposed to COCs by incidental inhalation of soil

particulates. Although the short-term exposure period would not likely exceed acceptable risk levels, engineering controls such as dust suppression will be implemented if weather conditions are such that the soil is dry and dust is prevalent. To prevent exposure to soil during the transportation process each haul truck will be covered. Workers at the site placing the soil in the trenches will wear appropriate personal protective equipment. In addition, standard practices such as washing hands and face and no eating or smoking at the site will minimize the risk of incidental ingestion of soil.

Air Force scheduling and budgeting dictate that removal actions associated with the Consolidation Unit are expected to take 4-6 years to complete. For the COCs already at the site there is very little risk of exposure as long as the soil is not disturbed. These soils are covered with 2-feet of clean fill therefore, there is no short-term risk for exposure. Similarly, for newly imported material, an interim cover will be installed to ensure that exposure pathways are not available to human or ecological receptors.

4.4 COMPLIANCE WITH ARARs

ARARs for the site are presented in Table 3. Site-specific ARARs include MCLs for groundwater; TSCA; FIFRA; RCRA Subtitle C; RCRA regulations for Identifying and Transporting Hazardous Waste; Disposal of Hazardous Waste; Guam Solid Waste Management, Water Quality, Historical Preservation, Coastal Zone Management, Water Pollution Control, and Air Quality regulations and CERCLA Removal Action regulations. The proposed Consolidation Unit meets all of the respective ARARs.

Table 3. Compliance with ARARs

Chemical Specific

Federal Authority: Safe Drinking Water Act (42 U.S.C., Ch. 6A, § 300[f]-300[j]-26)

Citation: 40 CFR 141.61(a)

ARAR determination: Relevant and appropriate

Synopsis of requirement: National primary drinking water standards are health-based standards (MCLs) for public water systems. The NCP defines MCLs as relevant and appropriate for groundwater that is a potential source of drinking water. Groundwater might be a source of drinking water, but there are no current production wells in the area.

Action to be taken to Attain Requirement: During implementation of the selected remedy, all CAMU eligible IRP wastes will be buried below ground surface and covered with a 2-foot layer of 2-inch minus coral and asphalt mix. After the waste is placed in the trench or mine pit it will be covered with a one-foot layer of mixed asphalt waste and a one-foot layer of coral. The coral will be compacted to an ASTM proctor of 85%. This procedure will facilitate water run-off and minimize infiltration through the buried

material.

Chemical Specific

Federal Authority: Resource Conservation and Recovery Act (RCRA)

Citation: These regulations take effect through Guam's authorized RCRA program. For reference purposes only, the federal RCRA regulations may be found at Part 261.3 (Definition of hazardous waste), Part 261.24 (Toxicity characteristic), and Part 262.11 (Hazardous Waste Determination)

ARAR determination: Relevant and appropriate

Synopsis of requirements: Pursuant to the "contained-in" policy, contaminated media must be managed as hazardous waste if the waste contains a listed hazardous waste.

Closure and post-closure requirements will meet substantive requirements for protection of the human and ecological environment.

Action to be taken to Attain Requirement: COC-impacted soils that exceed Toxicity Characteristic Leaching Procedure (TCLP) parameters will be accumulated on the respective IRP site in accordance with substantive provisions of RCRA regarding hazardous waste accumulation and will be shipped to a USEPA-certified off-island hazardous waste disposal facility, using Department of Transportation (DOT) standards and a DOT-certified transporter. Hazardous waste material will not be buried in the Consolidation Unit.

IRP remedial wastes will be consolidated at the LF-2 site located on Andersen Air Force Base. As the cells are constructed they will be covered either with an interim layer of asphalt and soil to preclude rainfall infiltration or if the cell's surface elevation is at final maximum contour based upon the drainage pattern of the surrounding area the cell will be covered with the asphalt mixture and a final coral cover. The final cover thickness will be a minimum of 2 feet. This final cover layer will be compacted to at least 85% ASTM proctor, will be contoured to facilitate the local drainage pattern, and will be maintained in good working order for a minimum of 30 years from the time of the last remedial waste addition.

The Andersen IRP Long Term Groundwater Monitoring Program that has been actively monitoring a series of wells in the LF-2 and Andersen Landfill complex areas will continue to serve as an early warning device for any potential leaching problems.

CERCLA requires 5-year reviews of Record of Decision documents when contamination above PRG's remains in the ground. These reviews will serve to ensure that the selected remedy continues to be protective of the human and ecological environment.

The Federal Facilities Agreement through the CERCLA IRP program will be responsible for the Remedial Waste Consolidation Unit located at Andersen Air Force Base, Guam. This responsibility includes consolidation of non-hazardous remedial wastes from 11 IRP sites, closure of the facility, and post-closure monitoring. Post closure ground water monitoring and maintenance of the alternative cover design will be required as long as contaminants of concern in the CU remain above industrial PRG levels.

Chemical Specific

Territorial Authority: No chemical specific territorial ARARs have been identified.

Location Specific

Federal Authority: Coastal Zone Management Act of 1972

Citation: Public Law 92-583, 16 U.S.C. 1451-1456

ARAR determination: Relevant and Appropriate

Synopsis of requirement: Guam Coastal Zone Management Program pursuant to Section 312 of the CZA provides for the protection and management of coastal waters and shorelines in Guam

Action to be taken to Attain Requirement: The Consolidation Unit location is not within the Guam Coastal Zone.

Location Specific

Territorial Authority:

Citation: 21 Guam Code Annotated, Chapter 76

ARAR determination: Applicable (if any historical objects are found during excavation)

Synopsis of requirement: Regulates the historical objects and sites on Guam. No archaeological sites have been documented near Site 2/Landfill 2.

Action to be taken to Attain Requirement: Excavation activities will be stopped should any historical objects be found. An archeological survey will then be conducted at the excavation site to preserve any artifacts or historical objects.

Action Specific

Federal Authority: Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Citation: 7 U.S.C. Section 136 et seq and 40 CFR Parts 150-189

ARAR determination: Applicable (if pesticides needed during revegetation)

Synopsis of requirement: Regulates sale, use, storage and disposal of pesticides.

Action to be taken to Attain Requirement: If pesticides are needed during revegetation, applicable requirements for use, storage & disposal of pesticides and their containers will be followed.

Action Specific

Federal Authority: RCRA Subtitle C

Citation: These regulations take effect through Guam's authorized RCRA program. For reference purposes only, the federal RCRA Subtitle C regulations may be found at 40 CFR Part 264

ARAR determination: Relevant and Appropriate.

Synopsis of requirement: Design and operating standards for containers and tanks used to store hazardous waste at CERCLA sites.

Closure of RCRA C facility.

Action to be taken to Attain Requirement: No Hazardous Waste will be stored on-site. No Hazardous Waste will be buried in the Consolidation Unit.

Closure of a RCRA C facility will not be required because hazardous waste not will be buried in LF-2.

Action Specific

Federal Authority: Toxic Substances Control Act (TSCA)

Citation: 40 CFR 761.61

ARAR determination: Applicable

Synopsis of requirement: Bulk PCB remediation wastes, such as PCB contaminated soil, may be sent off-site for decontamination or disposal in accordance with TSCA, provided that the remediation waste is either dewatered on-site or transported off-site in containers meeting the requirement of the DOT Hazardous Materials Regulations at 49 CFR parts 171 through 180. Bulk PCB remediation wastes with a PCB concentration of less than 50 ppm may be disposed of according to the requirements of TSCA 761.61(a)(5)(v)(A).

Action to be taken to Attain Requirement: PCB-impacted soils will be transported using DOT permitted contractors in accordance with TSCA.

Bulk PCB remediation wastes with a PCB concentration greater than or equal to 50 ppm shall be disposed of in a hazardous waste landfill permitted by EPA under section 3004 of RCRA, or by a State authorized under section 3006 of RCRA, or a PCB disposal facility approved under this part.

Action Specific

Territorial Authority: Solid Waste Management and Litter Control Act - Prohibited Hazardous Waste Activities

Citation: 10 Guam Code Annotated (GCA), Chapter 51 - Section 51110 –51111

ARAR determination: Relevant and Appropriate

Synopsis of requirement: Regulates solid waste collection and disposal on Guam.

"The 10 Guam Code Annotated Chapter 51 defines a hazardous waste as:
(21) *Hazardous Waste* means any material or substance which, by reason of its composition or characteristics, (i) is hazardous waste as defined in the Solid Waste Disposal Act, 42 USC §6901, et seq., as amended, replaced or superseded and the regulations implementing same, (ii) is a hazardous substance as defined by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 USC § 9601, et seq., (iii) is material the disposal of which is regulated by the Toxic Substances Control Act, 15 USC § 2601, et seq., as amended, replaced or superseded, and the regulations implementing same, (iv) is special nuclear or by-products material within the meaning of the Atomic Energy Act of 1954, (v) is pathological, infectious or biological waste, (vi) is treated as hazardous waste or as a hazardous substance under applicable law,(vii) requires a hazardous waste or similar permit for its storage, treatment, incineration of disposal, (viii) may cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness, or (ix) may pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise

damaged." (The last word in this definition is probably not correct. The word in the Federal Statute is "managed".)

Action to be taken to Attain Requirement: Disposal of materials at the Andersen AFB Consolidation Unit will comply with all substantive requirements.

The Andersen IRP policy manages remedial waste based on risk analysis. For any contaminant to pose a risk, four elements must exist at the site:

- A source of chemical contamination that exceeds or could generate chemical contamination above health-protective or aesthetic standards;
- A mechanism of contamination release;
- A human or ecological receptor available for chemical contact, and
- A completed exposure pathway through which that receptor will contact the chemical.

If any one of these elements are absent or effectively controlled then there is no immediate or present risk. The CERCLA process coordinated by the Air Force through the Federal Facilities Agreement successfully manages risk so that human and environmental receptors will not be negatively impacted.

Remedial wastes that have been imported and buried at LF-2 have been analyzed utilizing EPA Method 1311 (Toxic Characteristic Leaching Procedure). This method has been utilized and will continue to be utilized to determine if wastes exhibit hazardous characteristics. Any wastes that continue to exhibit hazardous characteristics after any stabilization processes are applied will be transported off of Guam to an EPA licensed TSDF.

Empirical evidence from the Andersen AFB Long Term Groundwater Monitoring Program shows that no contaminant concentrations above MCL's have migrated or leached from the LF-2 consolidation unit to the groundwater. This data substantiates that the material that was originally in the LF-2 landfill and the material that has been imported to the LF-2 landfill has not migrated to groundwater in concentrations exceeding MCLs.. The constructed cover over the buried wastes in LF-2 and the implemented Institutional Controls effectively and efficiently isolate human and ecological receptors from the buried wastes.

Action Specific

Territorial Authority: Guam EPA Air Pollution Control Standards and Regulations - Section 1103.4 Fugitive Dust

Citation: Guam's Air Pollution Control Standards and Regulations, promulgated under

the authority of Chapter 49, Title 10 of the Guam Code Annotated (GCA), also known as the Air Pollution Control Act (P.L. 10-74) - Section 1103.4(a)(1) **ARAR determination:** Applicable **Synopsis of requirement:** Guam requires reasonable precautions to be taken with respect to the creation of visible fugitive dust. **Action to be taken to Attain Requirement:** Water spray will be used to suppress dust emission from dump trucks driving on unpaved roads.
Action Specific **Territorial Authority:** Water Pollution Control Act **Citation:** 10 Guam Code Annotated, Chapter 47 **ARAR determination:** Relevant and Appropriate **Synopsis of requirement:** Protects groundwater and waters of the territory. **Action to be taken to Attain Requirement:** No hazardous wastes will be buried in the Consolidation Unit

4.5 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The Consolidation Unit alternative meets the criteria for overall protection of human health and the environment both short term and long term from unacceptable risks posed by consolidation of eligible wastes.

4.6 IMPLEMENTABILITY

The Consolidation Unit alternative is a tried and proven effective technology for CERCLA sites. There are no extensive permit requirements necessary to designate a site as a Consolidation Unit. The technologies for addressing the COCs are soil stabilization for lead impacted soil and soil cover for all waste materials that exceed RGOs. A bench test was conducted on the soil at Site 24/Landfill 29 to determine if soil stabilization was feasible

(Bench-Scale Stabilization Study Results for Lead-Impacted Soil at Site 24/Landfill 29 and Site 22 Waste Pile 6, Andersen Air Force Base, Guam, December 1999). The results of the bench test indicated that 1 % TSP significantly reduces the leachability of lead in soil. TSP can be readily purchased, handled and mixed with the soil. The soil cover technology requires clean backfill. This material will be purchased or mined on island and tested prior to using. The cover material will be analyzed for metals, SVOCs, PAHs, pesticides and PCBs. A staging area will be setup on the site to temporarily store and mix waste material as required prior to placement in the trenches. The cover will be inspected through the existing Andersen Air Force Base operation and maintenance program.

4.7 COSTS

The proposed alternative has capital costs for construction. Details of capital costs are presented in Table 2.

Operation and Maintenance and 5-year review costs will be administered under an existing program. Based upon present experience concerning operational and maintenance costs for the existing Consolidation Unit cover significant additional money should not be required to maintain the new area.

The construction cost for the Andersen Landfill was approximately $5,000,000. This number divided by the permitted capacity of the landfill equates to a $28.00 per cubic yard cost for the material being delivered to the landfill. The diversion of the future remedial wastes from the landfill will save approximately 1.1 million dollars of landfill space equivalence.

4.8 TERRITORY ACCEPTANCE

The document will be initially reviewed by the USEPA and GEPA for comments on the EE/CA. The Air Force will prepare a response to comments document for the respective agencies to review and the final draft EE/CA document will be revised as a result of acceptance of the response to comment document. In accordance with NCP regulations, this EE/CA document will be made available to the public for a 30-day review and comment. A notification of availability to review the draft final EE/CA will be published in the local newspaper the *Pacific Daily News*. A Removal Action memo or work plan will be submitted to the USEPA and GEPA for review. The work plan will have further details on the removal action and proposed construction activities. The Air Force will address comments from USEPA and GEPA and revise the document accordingly. The date of availability for review will be presented in the *Pacific Daily News*.

4.9 COMMUNITY ACCEPTANCE

The Air Force will address any comments made by public during the Public Review Period for the EE/CA. Comments can be sent to the Air Force at:

Andersen AFB
36 CES/CEV
Unit 14007
APO AP 96543-4007
Attention Gregg Ikehara

The EE/CA will not be finalized until the Air Force addresses public concerns regarding the site. This EE/CA and the subsequent Action Memorandum will be on file in the Information Repository at the JFK Library at the University of Guam and the Nieves Flores Library in Hagatna.

After comparing the above-referenced remedial action alternatives, the Air Force selected the Consolidation Unit option as the preferred alternative because the scenario greatly extends the lifetime of the Andersen Municipal Solid Waste Landfill (MSWL). Following the addition of impacted non-hazardous surface soils and asphalt debris, the mine pit and trenches would be filled to original ground surface. One foot of asphalt mixed with eligible waste and at least one foot of clean coral cover would then be applied and compacted to 85% ASTM proctor. The final coral cover, consisting of 2" minus material, will be contoured to ensure proper drainage off of the buried wastes. The Consolidation Unit Alternative includes institutional controls that would impose administrative restrictions for future land use and would place limitations and controls on excavations in the area. This alternative would allow less restrictive future land use at cleaned up sites and consolidates management of remedial wastes.

The Consolidation Unit will be created to facilitate the implementation of reliable, effective, protective and cost-effective remedies. Only non-hazardous waste from remedial/removal actions will be managed in the Consolidation Unit. CERCLA and RCRA regulations have specific technical requirements for groundwater monitoring, closure and post-closure. A groundwater-monitoring program to monitor the impact of COCs to the groundwater beneath the site complex already exists.

5.0 REFERENCES

Andersen Air Force Base, Guam, Mariana Islands, September 17, 1996, Solid Waste Management Complex Phase 2 – Landfill Complex Basis of Design

Andersen Air Force Base, Guam, December 1999, Bench-Scale Stabilization Study Results for Lead-Impacted Soil at Site 24/Landfill 29 and Site 22 Waste Pile 6

Andersen Air Force Base, Guam, May 1999, Final Engineering Evaluation/Cost Analysis (EE/CA) for IRP Site10/Landfill 14

Andersen Air Force Base, Guam, November 2000, Asphalt Recovery Status Report, Installation Restoration Program Site 35/Waste Pile 1, Main Base

Andersen Air Force Base, Guam, February 2000, Final Engineering Evaluation/Cost Analysis (EE/CA) Report For IRP Site 2/Landfill 2

Andersen Air Force Base, Guam, August 2001, Final Engineering Evaluation/Cost Analysis for IRP Site 36, Ritidian Point Dump Site

Andersen Air Force Base, Guam, October 2001, Final Engineering Evaluation/Cost Analysis for IRP Site 9, Landfill 13

Andersen Air Force Base, Guam, June 2002, Final Engineering Evaluation/Cost Analysis for IRP Site 14, Landfill 19

Andersen Air Force Base, Guam, September 2002, Final Engineering Evaluation/Cost Analysis (EE/CA) Report for IRP Site 15/Landfill 20

Andersen Air Force Base, Guam, November 2002, Final Engineering Evaluation/Cost Analysis For IRP Site 6/Landfill 8

Andersen Air Force Base, Guam, November 2002, Final Engineering Evaluation/Cost Analysis For IRP Site 12/Landfill 17

Andersen Air Force Base, Guam, June 2003, Agency Draft Record of Decision for Dumpsites 1 and 2 Urunao Operable Unit

Andersen Air Force Base, Guam August 2003, Final Engineering Evaluation/Cost Analysis For IRP Site 26/Firefighter Training Area-2

US EPA, December 1996, Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills

TABLE 1.

LF-2 EECA CERCLA CONSOLIDATION UNIT 12/04

COPC COMPARISON

CERCLA	EPA	TCLP	Range of values	Range of values	Range of values	Range of values	Range of values	Range of values	Range of values	Range of values	Range of values	Range of values	Range of values	Range of values
IRP Site	Residential	Hazardous	ppm max value	ppm max value	ppm max value	ppm max value	ppm max value	ppm max value	ppm max value	ppm max value	ppm max value	ppm max value	ppm max value	ppm max value
COPCs	PRG	Characteristic	COPCs/Materials	COPCs/Material	COPCs/Material	COPCs/Material	COPCs/Material	COPCs/Material	COPCs/Material	COPCs/Material	COPCs/Material	COPCs/Material	COPCs/Material	COPCs/Material
	ppm	ppm	LF2/LF29	Raridan	Urunao	LF14	LF20	LF8	LF18	FTA2	LF13	LF17	LF19	
4 4 DDD 4 4 DDT	2 4 1 7		15	15	8		17 6		0 255		10 96	0 734 1118	1 2	
4 4-DDE	1 7		3	14			6 5		0 156		1 7	67 3	0 8	
Alpha	0 029		0 047				0 279		0 00038	0 002	0 001		0 001	
Aluminum	76000		242000					199000	111000		107000	272000	190000	
Antimony	31	1	183/300	4800	175	1090			6 2		266	4790	6 7	
Arachlor 1248 1254 1260	0 22		21		0 972		8 272				0 148		109	
Arsenic	22	5	53		173	9 5	86 3		321	7 5	21 6	908	222	
Asbestos	>1%		None	None	None	None	>1%	None	None	None	None	None	None	
Asphalt	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Asphalt drums	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Automobile parts	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Barium	5400	100	876	1420	8090			30 8	528	232	563	3600	54 4	
Benzo(a)anthracene	0 62		0 68			2			0 28	2 4	0 31	260	0 21	
Benzo(a)pyrene	0 062		0 88	0 8	278	3	0 694		0 33	4 2	1 27	290	0 314	
Benzo(b)fluoranthene	0 62		2 7	0 9		3 4	1 013	0 24	0 3	6 8	1 68	270	0 36	
Beryllium	150		4 4					5 97	3 4		3 1	58 3	5 6	
Cadmium	37	1	38	562	30		78 6	6 3	46	12 7	180	2640	8 8	
Chromium	210	5	1200	1800			1290	1140	493	383	1110	1460	1050	
Cobalt	900		61					18 6	168		52 7	1060	20 8	
Concrete slabs	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Copper	3100		418	9400	5120	472		21 9	158	504	4230	12600	37	
Deteriorated metal containers	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Dibenz(a h)anthracene	0 062		0 13	0 29	0 167	0 43	1 18	1 46	0 01	0 12	0 12	50	0 048	
Dieldrin	0 03		0 87		0 041		4 9		0 01	0 024	0 015	9 43	0 002	
Dioxins	0 0000039		0 000265	0 000996	0 000513					0 0000021				
Glass	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Heptachlor Epoxide	0 053		0 45				3 232			0 022	0 002	0 01	0 001	
Iron	230000		4960		467000		182000		144000		350000	321000	120000	
Lead	400	5	8300/124000	37000	53400	119000	1740	100	686	71	13700	147000	3970	
Magnesium	N/A		N/A						3350		6090	5540	5020	
Manganese	5700 BTV		5580	6380	7100	4650	4390		27400		3560	7310	5220	
Mercury	23	0 2	10 4				25 8	0 31	1		0 82	4 3	1 3	
Nickel	1600	7	144						523		833	2780	101	
Piping	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Scrap metal	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Silver	390	5	328						2 2		2 13	3 4	12 6	
Thallium	5 2	7	45 4					2	6		1	2 4	2 2	
Vanadium	550		290						90 7		40 6	237	131	
Wooden Poles creosote	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Zinc	230000		4770						1240		19400	161000	268	
Alpha chlordane	1 6		0 63				48 6		0 02		0 05	0 21	0 01	
Bis(2-chloroethyl)ether	0 21		0								1 54			
Benzo(b k)fluoranthene	0 62 6 2		2 7			3 4			0 3	6 8	1 68	270	0 36	
Chrysene	62		2 3						0 383	3 2	0 51	140	0 257	
Cyanide	1200		1 9						4 47		1 81	2 45	1 84	
Gamma-chlordane	1 6		1 4				54 4				0 01	0 002	0 01	
Hexachlorobenzene	0 3		0		0 713									
Fluoranthene	230000		2 2							2 1	0 44	260	0 25	
Indeno(1 2 3-cd)pyrene	0 62		0 77	1 3		1 7			0 46	1 5	1 08	300	0 63	
Molybdenum	390		0								23 6	49 7	10 2	
Pentachlorophenol	3		0 3									9 97		
Pyrene	2300		2 2					276	0 72	3 5		240	0 26	

SHADED CELLS REPRESENT COPCS NOT PRESENTLY IN LF-2

REMEDIAL WASTES THAT EXCEED THE TCLP VALUE WILL BE SHIPPED TO APPROVED TSDF

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE